The CHEM Mission

In 2002, NASA will launch its Earth Observing System's CHEM satellite into polar orbit on a Delta rocket. Once in orbit CHEM is designed to operate for at least 5 years.

CHEM Instruments

CHEM's instruments, HIRDLS, MLS, OMI, and TES, contain advanced technologies that have been developed for use on environmental satellites. Each instrument provides unique and complementary capabilities that will enable daily global observations of Earth's atmospheric ozone layer, air quality, and key climate parameters.

HIRDLS

High Resolution Dynamics Limb Sounder

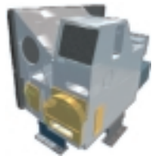
HIRDLS will measure atmospheric infrared radiation emitted by ozone, water vapor, CFC's, methane, and nitrogen compounds. In addition, HIRDLS will track the transport of ozone between the stratosphere and the troposphere. HIRDLS is being built jointly by NASA and the United Kingdom.

MLS

Microwave Limb Sounder

MLS will measure microwave radiation emitted by ozone, chlorine compounds, and many other trace gases. MLS upper tropospheric water vapor measurements will clarify the role this key greenhouse gas plays in global warming.

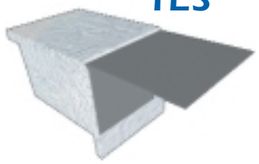
OMI



Ozone Monitoring Instrument

OMI will measure both UV and visible radiation and will provide daily high-resolution global maps and profiles of ozone. OMI will also measure nitrogen dioxide, aerosols, other trace gases, and UV-B radiation. OMI is being developed by the Netherlands Space Agency (NIVR) and the Finnish Meteorological Institute (FMI).

TES



Tropospheric Emission Spectrometer

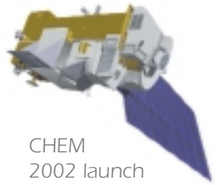
TES will make the first direct global measurements of tropospheric ozone as it measures atmospheric infrared radiation at high-wavelength resolution. TES will also measure tropospheric carbon monoxide, methane, nitric acid, water vapor, nitric oxide, and nitrogen dioxide.

The CHEM Spacecraft

The CHEM spacecraft is being designed by TRW to provide the pointing accuracy and stability needed by its four instruments to take precise measurements. The spacecraft is being built with lightweight graphite-epoxy. The power system will use highly reliable nickel-hydrogen batteries.

NASA's Atmospheric Chemistry Missions

NASA has been making measurements of Earth's upper atmosphere from satellite missions since the mid-1970's.



CHEM
2002 launch

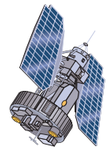
CHEM will be the first satellite to measure the chemistry of the lower atmosphere with multiple instruments. CHEM's instruments will also map aerosols and water vapor, key measurements needed for climate studies.

UARS
1991–present

The **Upper Atmosphere Research Satellite (UARS)** was the first satellite to measure stratospheric chlorine radicals and reservoirs from space. UARS made the first satellite measurements of wind as well as solar UV and energetic particles.

TOMS, SAGE
1979– present

The **Total Ozone Mapping Spectrometer (TOMS)** series has made column ozone measurements for almost 20 years. The **Stratospheric Aerosol and Gas Experiment (SAGE)** series has monitored Earth's stratospheric ozone and aerosol profile for the same period.



Nimbus–7
1978–1992

Nimbus–7 was the first satellite to map the Antarctic ozone hole and obtain global profiles of ozone and nitrogen reservoir gases. Nimbus–7 instruments made ozone measurements for 13 years.

EOS CHEM PROJECT
http://eos-chem.gsfc.nasa.gov/

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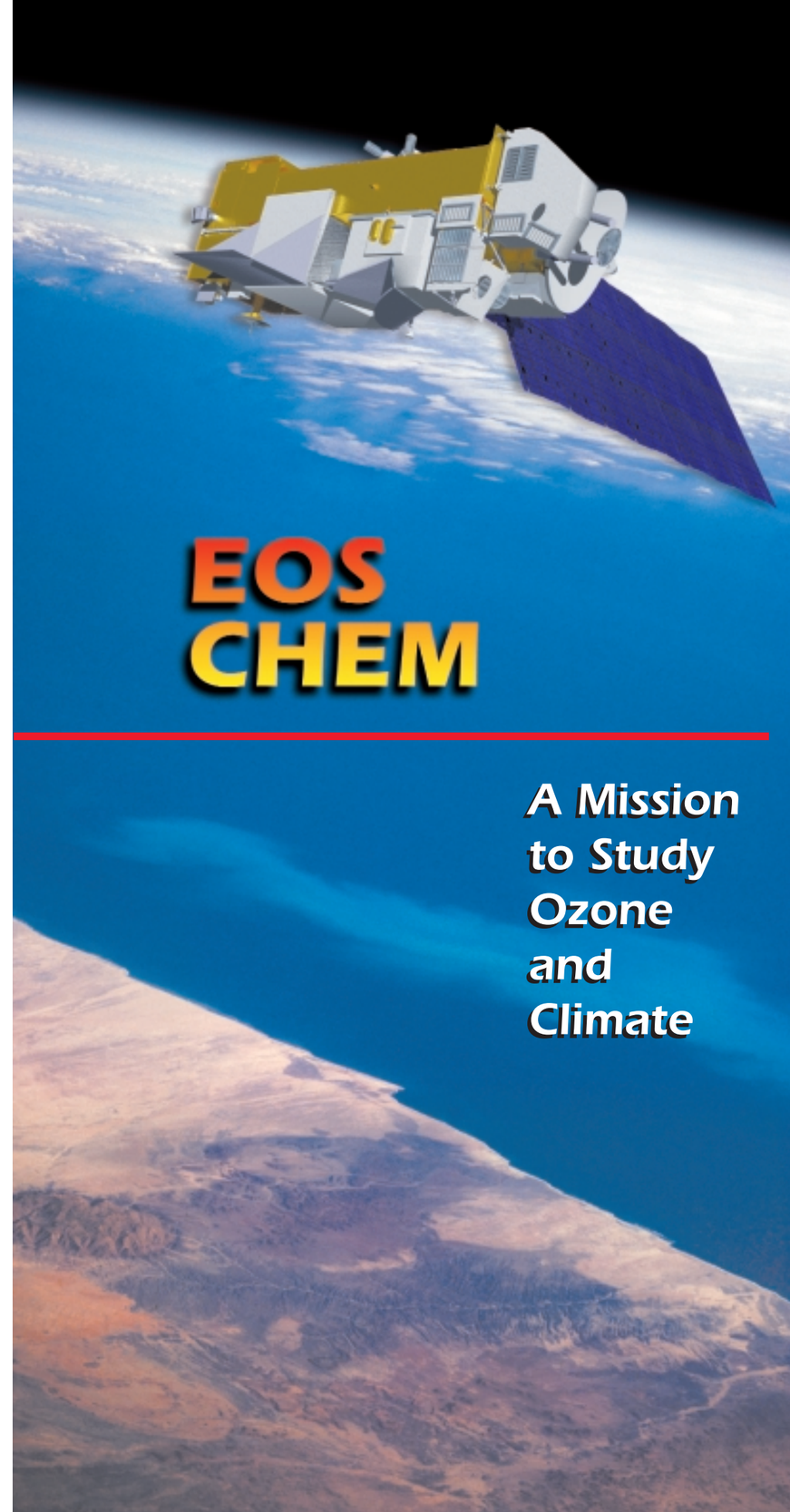


EOS CHEM

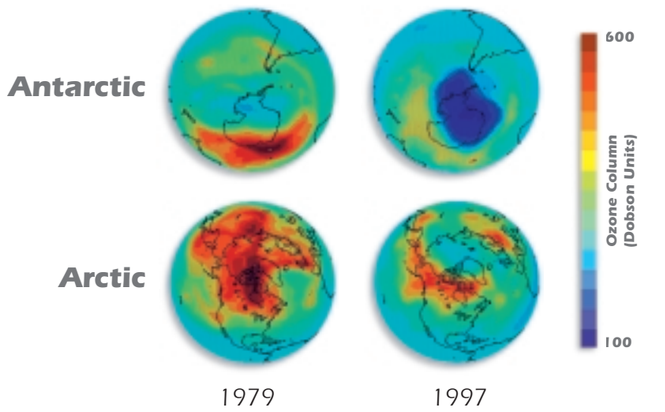
Is Earth's ozone layer recovering?

The Earth's stratosphere contains the ozone layer, which shields us from the Sun's harmful ultraviolet (UV) radiation.

Ozone is destroyed through chemical reactions involving natural and man-made nitrogen, hydrogen, bromine, and chlorine compounds. The release of chlorofluorocarbons (CFC's) has caused a dramatic decrease in the protective stratospheric ozone layer during the last two decades.

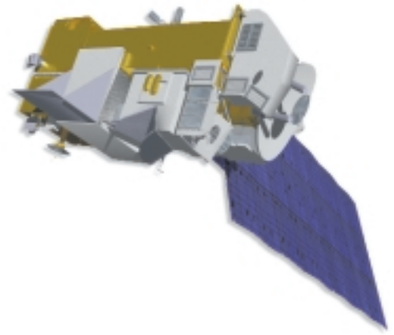
Detection of stratospheric ozone depletion led to regulation and phase-out of CFC production worldwide. As a result, man-made chlorine levels in the atmosphere are slowly beginning to decrease. CHEM will be able to determine whether the stratospheric ozone layer is now recovering, as predicted by scientific models.

CHEM will make improved measurements of ozone and ozone-depleting compounds. CHEM will also measure the trace gases that control these compounds.



Ozone Depletion Over Earth's Poles

Polar ozone depletion over an 18-year period as measured by NASA's Total Ozone Mapping Spectrometer (TOMS). Across the top, South Polar ozone on October 3, 1979, and October 3, 1997; across the bottom, North Polar ozone on March 28, 1979, and March 28, 1997. Red indicates high ozone amounts; blue indicates low ozone amounts.



A NASA Mission to Study Earth's Ozone and Climate

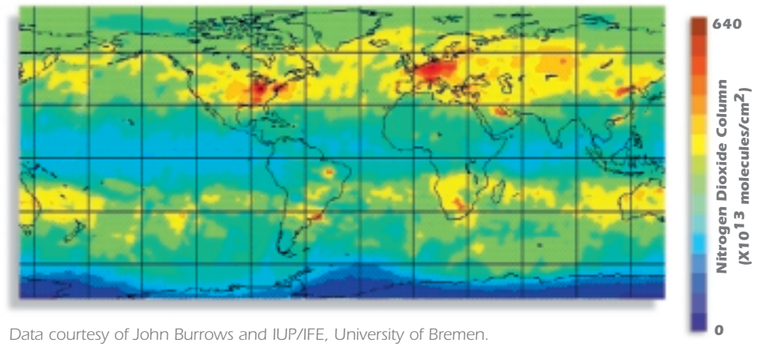
EOS CHEM will be the first satellite designed to measure the lower atmospheric chemical composition with multiple instruments. CHEM will also measure key chemical compounds associated with stratospheric ozone depletion. CHEM will address three major science questions concerning human impact on ozone depletion, air quality, and climate change in the 21st Century.

Is air quality changing?

The chemical composition of Earth's lower atmosphere, the troposphere, is changing. The pollutants nitrogen oxide, carbon monoxide, and ozone are by-products of agricultural burning, deforestation, and urban activity. These pollutants are increasing worldwide.

CHEM will provide a global picture of the chemical changes taking place in the troposphere. These measurements are critical in assessing the future habitability of the planet.

CHEM will make space-based global measurements of lower atmospheric natural and man-made pollutants such as nitrogen dioxide, carbon monoxide, and ozone.



Data courtesy of John Burrows and IUP/IFE, University of Bremen.

September 15, 1996

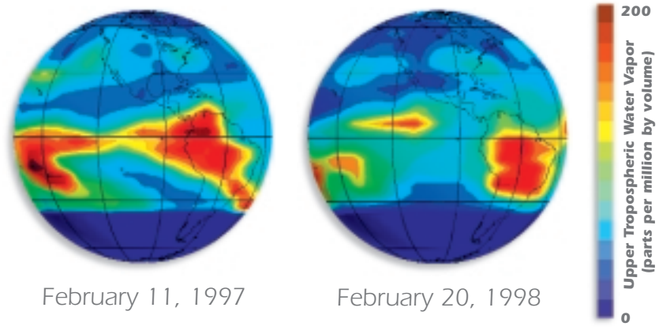
Global Air Pollution

Toxic nitrogen dioxide is a by-product of urban pollution and biomass burning. Data from the European Global Ozone Monitoring Experiment (GOME) instrument on the European Space Agency's ERS–2 satellite show elevated amounts of nitrogen dioxide near urban industrial centers in North America, Europe, and South America. Agricultural burning increases atmospheric nitrogen dioxide in Brazil and South Africa. CHEM will provide global maps of nitrogen dioxide, aerosols, carbon monoxide, ozone, and other tropospheric pollutants.

How is Earth's climate changing?

Ozone and water vapor in the upper troposphere play a significant role in controlling our climate. To predict the temperature changes that will accompany increases in carbon dioxide, we need to understand how ozone and water vapor regulate our climate, and how they are exchanged between the stratosphere and the lower atmosphere.

CHEM will continue NASA's measurement of upper tropospheric aerosols, ozone, and water vapor—all key components of our climate system.



February 11, 1997 February 20, 1998

Climate Change During 1997–1998 El Niño

1997–1998 UARS MLS measurements show the shift in humidity patterns associated with El Niño-caused rainfall changes in the east Pacific. Due to lack of rain during the 1997–1998 El Niño, fires raged uncontrollably in northern Mexico and South America, destroying millions of acres of forests. CHEM is designed to improve the accuracy of water vapor measurements in the upper troposphere.

EOS
Earth Observing System
NASA Earth Science Enterprise